Photocatalysis in Environment, Energy, and Sustainability - Editorial

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Editorial

Photocatalysis in Environment, Energy, and Sustainability

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Photocatalysis has attracted enormous attention in solar energy conversion to provide renewable and sustainable energy source, thus solving the serious environmental and energy-related problems. Those applications include hydrogen evolution by water splitting, CO_2 conversion to hydrocarbon fuels, photocatalytic pollutants degradation, and water disinfection. In the past few decades, TiO_2 has been the most commonly used photocatalyst because of its low-cost, nontoxicity, and high efficiency with UV-irradiation. Meanwhile, in recent years, researchers have turned their focus to novel materials and advanced technology that may bring photocatalysis into practical use. In this regard, to move this field forward, we invited investigators to contribute original research articles on recent development of photocatalysis in environment, energy, and sustainability. This special issue consists of 9 papers, mainly related to environmental purification by using various advanced photocatalysts. A brief summary of all accepted papers is provided below.

In "Adsorption and Photocatalytic Kinetics of Visible-Light Response N-Doped TiO_2 Nanocatalyst for Indoor Acetaldehyde Removal under Dark and Light Conditions," the paper investigated the removal of indoor acetaldehyde using N-doped TiO_2 photocatalyst under visible light irradiation. It was found that the mesoporous N-TiO_2 had a high ability to absorb acetaldehyde, which was subsequently photooxidized under visible-light irradiation. The increase in temperature would result in the decrease in the adsorption rate of indoor acetaldehyde.

The paper "Evaluation of the Antimicrobial Activity of Nanostructured Materials of Titanium Dioxide Doped with Silver and/or Copper and Their Effects in *Arabidopsis thaliana*" reported the sol-gel synthesis of Cu^{2+}-TiO_2 and Ag@TiO_2 as nanostructured photocatalysts for microbial disinfection. The Ag@TiO_2 was more active than Cu^{2+}-TiO_2, while *E. coli* was more sensitive to Ag@TiO_2 than *S. cerevisiae*. The impact of the as-prepared photocatalysts in plants was evaluated by exposing *Arabidopsis thaliana* Col-0 strain to these materials at different conditions and concentrations. Deleterious effects on *A. thaliana* due to exposition of silver base materials were observed at longer times of exposures and higher concentrations of photocatalysts.

The paper "Synthesis of CdS Sensitized TiO_2 Photocatalysts: Methylene Blue Adsorption and Enhanced Photocatalytic Activities" reported the microwave-assisted hydrothermal synthesis of a series of CdS/TiO_2 nanocomposite with different Cd to Ti molar ratio by using P25-TiO_2 nanopowder as the raw materials. Results showed that CdS/TiO_2 photocatalysts with low Cd to Ti molar ratios exhibited much higher activities than P25-TiO_2, and the CdS/TiO_2 sample with 20% CdS/(TCd2) showed the highest activity among all these samples, which is attributed to the low rate of electron-hole recombination.

The paper "TiO_2/Halloysite Composites Codoped with Carbon and Nitrogen from Melamine and Their Enhanced Solar-Light-Driven Photocatalytic Performance" reported the fabrication of C and N codoped anatase TiO_2/amorphous

halloysite nanotubes (C,N-TiO_2/HNTs) using melamine as C and N source. The as-prepared C,N-TiO_2/HNTs showed higher photocatalytic activity for the degradation of methylene blue than that of TiO_2/HNTs.

In the paper "Synthesis of CuO/Co_3O_4 Coaxial Heterostructures for Efficient and Recycling Photodegradation," a highly efficient CuO/Co_3O_4 composite was synthesized on Cu wire mesh by a simple hydrothermal method. These CuO/Co_3O_4 coaxial heterostructures were easy to recycle and exhibited enhanced photocatalytic activity for the degradation of methylene blue than that of single CuO nanorod arrays.

The paper "Evaluation of La-Doped Mesoporous Bioactive Glass as Adsorbent and Photocatalyst for Removal of Methylene Blue from Aqueous Solution" reported a series of La-doped mesoporous bioactive glasses (BG-La) with excellent biosafety and hypotoxicity. The BG-La showed higher photocatalytic activity than undoped mesoporous bioactive glasses (BG). The MB loaded on BG-La could be easily desorbed with acid solution due to its electronegativity and mesoporous structure.

In the paper "New TiO_2/DSAT Immobilization System for Photodegradation of Anionic and Cationic Dyes," a new technique to immobilize TiO_2 was developed by coating TiO_2 solution onto double-sided adhesive tape (DSAT) as a thin layer binder without adding any organic additives. The immobilized TiO_2/DSAT showed lower and higher photocatalytic activity for the degradation of reactive red 4 and methylene blue than that of TiO_2 powders in suspension mode, respectively. The DSAT provided a very strong interaction between glass and TiO_2 layers, and therefore the reusability of immobilized TiO_2/DSAT could be up to 30 cycles.

In the paper "Hydrophobic ZnO-TiO_2 Nanocomposite with Photocatalytic Promoting Self-Cleaning Surface," ZnO nanorod array film on quartz crystal microbalance is modified by β-CD in hydrothermal process and then decorated by P25-TiO_2 after impregnating in its suspension. The as-prepared films exhibited excellent hydrophobicity as well as self-cleaning property for organics under UV-irradiation.

The paper "Enhanced Photocatalytic Property of Cu Doped Sodium Niobate" reported the synthesis of Cu doped $NaNbO_3$ by modified polymer complex method. Compared with pristine $NaNbO_3$, the as-prepared Cu-$NaNbO_3$ showed enhanced photocatalytic activity for H_2 evolution from methanol aqueous solution as well as degradation of rhodamine B (RhB) under visible light irradiation. The Cu doping was found to improve the adsorption property of $NaNbO_3$ and accelerate the mineralization process.

Acknowledgments

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